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The tenth and last chapter deals with heredity and sex. The hypothesis offered by the author several years ago that the female regularly possesses a chromatic element, or something else in addition to the possessions of the male, is made the key to the entire discussion of this subject, and a series of facts is presented which give the hypothesis considerable apparent plausibility, although the philosophical basis for it seems to the reviewer to be a little strained. This basis is found in the statement that the female as compared with the male has an additional function, namely the supplying of nourishment to the young zygote. On the other hand, it may be pointed out that the male differs from the female in many functions, and is in many respects morphologically and physiologically the superior sex, and it is possible to interpret these differences as additions to the female. If the egg has the added function of nourishing the young zygote, the sperm has the added function of motility, and there seems no better a priori ground for expecting an additional chromatin element to represent one of these additions than the other. The reviewer believes that there is no sufficient ground at present for the assumption that sex is always determined in the same manner. It cannot be determined as yet whether the basic differences between the sexes are quantitative or qualitative, and in either case the same results might be attained by any one of several different methods. The attempt to bring the sex-phenomena of all organisms under a single viewpoint is premature.

Each of the chapters is followed by a "bibliography," but the meagerness of the literature lists may be judged from the fact that they include only 46 titles from 26 authors, including 14 of CASTLE's own papers. This may be compared with the bibliography appended to another recent book on heredity which includes 426 titles from 170 authors. However, this is not intended as an adverse criticism of CASTLE's excellent book, but is mentioned to show the limitations of its author's aims. Extensive literature lists are indispensable to students, but would defeat their own purpose in a book intended primarily for popular reading.

The press work is excellent and typographical errors are few, though "reversion" is rendered "revision" in the heading of chap. iv.—GEORGE H. SHULL.

NOTES FOR STUDENTS

The mycoplasma theory.—In spite of many attempts to establish the truthfulness or fallacy of ERIKSSON's mycoplasma theory, its status has not been definitely settled, and it continues to be a subject of controversy. An outline of the history and the present status of the theory is presented by ERIKSSON² in a brief article occasioned by MARESCHKOWSKI's³ appropriation

² ERIKSSON, J., Über die Mykoplasmatheorie, ihre Geschichte und ihren Tagesstand. *Biol. Centralbl.* 30:618-623. 1910.

³ MARESCHKOWSKI, C., Theorie der zwei Plasmaarten als Grundlage der Symbiogenesis. *Biol. Centralbl.* 30:278 ff. 1910.

of the term *mycoplasma* to designate one of the two types of protoplasm which he conceives to be the fundaments of which the organic world is built up. The article is a convenient historical summary but adds no new material to what has already been published. In it the author again calls attention to the fact, often emphasized by him, that the study of secondary rust pustules, as carried out by WARD and others, cannot have any bearing on the theory which is concerned only with the origin of the primary pustules. In concluding the author expresses a wish for a complete investigation of the whole problem.

ZACH,⁴ in a paper dealing with the results of a cytological investigation of the pustules of *Puccinia graminis* and *P. glumarum*, comes to the conclusion that the mycoplasma theory is untenable and rests on a misinterpretation of the facts which, in themselves, he concedes are correctly described by ERIKSSON. ZACH studied microtome sections and free-hand sections of *P. graminis*, but only free-hand sections of fixed material of *P. glumarum*. From this material he describes processes of disorganization of the tissues. At the margin of the rust pustules the host cells have a turbid, deeply staining protoplasm which he identifies with ERIKSSON's resting mycoplasma. The nuclei of these cells are much hypertrophied and seem to be filled with hyphae, some of which extend to the cell wall. The filaments degenerate and fuse into irregular lumps. The nucleus decreases in size and finally becomes an amorphous homogenous body termed an excretion product. Similar smaller bodies occurring throughout the cell he regards as identical with the "plasmannucleoli" of ERIKSSON. In more advanced stages the hyphae are largely dissolved, leaving only small amorphous particles. These processes, by which the cell and the parasite mutually destroy each other, resemble those formerly described by the author in his studies on the root tubercles of cycads. The process is termed phagocytosis, analogous to that phenomenon in animals. The figures accompanying the paper represent in a general way processes in cells undergoing disorganization as the result of the action of the fungi or other agents, which cause a slow dying of the cells. The "hyphae" figured bear not the least resemblance to the hyphae or haustoria of rusts.

In a criticism of the foregoing paper, ERIKSSON⁵ points out that ZACH fails to state that he confined his studies to the primary uredo pustules, and furthermore that the pustules investigated by him were too far advanced to show stages of the mycoplasma, which is present only before the pustules become visible. The formations observed by ZACH belong to a later stage in the life of the rust. The various "excreted" bodies described by ZACH, ERIKSSON finds

⁴ ZACH, F., Cytologische Untersuchungen an den Rostflecken des Getreides und die Mycoplasmatheorie. Sitzungsab. K. Akad. Wiss. Wien Math.-Naturw. Kl. 119:307-330. pls. 2. 1910.

⁵ ERIKSSON, JAKOB, F. ZACH's cytologische Untersuchungen über die Rostflecken des Getreides und die Mycoplasmatheorie. Sitzungsab. K. Akad. Wiss. Wien Math.-Naturw. Kl. 119:pp. 8. 1910.

only in advanced stages of cell disorganization, and not during the mycoplasma stage. ERIKSSON also fails to find "hyphae" in the disorganizing nucleus, but believes the structures interpreted as such by ZACH to be chromatin threads.

A paper by BEAUVERIE⁶ relates to the "plasmanucleoli" described by ERIKSSON. BEAUVERIE finds in the cells of fungi certain granules stainable with basic dyes, which he terms "corpuscules métachromatiques." In wheat plants attacked by rust he finds similar bodies in the mycelium, and in the host cells in the regions invaded by the fungus, but not in the normal cells. These granules he identifies with the plasmanucleoli of ERIKSSON. Just how giving these bodies a new name would, in itself, invalidate ERIKSSON'S interpretation or constitute a new interpretation is not easy to see.

The solution of the problem which gave rise to the mycoplasma theory probably lies in the direction suggested by the recent work of PRITCHARD⁷ on rust-infected grain seeds. PRITCHARD finds that rust-infected wheat seeds, to which little attention has been given from this viewpoint, contain living mycelium in the neighborhood of the rust sori. When such seeds are planted the fungus resumes its activity with the growth of the seedling, and penetrates both the stem and root of the young plant. It also grows in the spaces between the leaf sheaths. The formation of new uredo pustules from this mycelium has not been observed, nor have rusted wheat plants been obtained from infected seed grain under conditions rigorously excluding external infection.—H. HASSELBRING.

Spermatogenesis in Bryophytes.—WILSON⁸ has completed his studies of spermatogenesis in *Mnium hornum* and also has investigated spermatogenesis in *Atrichum undulatum* and *Pellia epiphylla*. Because of the somewhat remarkable statements of J. and W. Docters VAN LEEUWEN-REIJNVAAN that centrosomes are constantly present in the spermatogenous cells in several species of *Polytrichum* and *Mnium*, and that in the ultimate division of these cells a reduction takes place whereby the haploid number of chromosomes is reduced to half (in *Polytrichum* to 3, and in *Mnium* to 4), these later divisions were studied with exceeding care.

In *Mnium hornum*, in the early stage of the penultimate division in spermatogenesis, a body is cut off by constriction from the nucleolus. In earlier divisions of the spermatogenous cells this division of the nucleolus was not observed. This body was never discovered outside of the nucleus and soon

⁶ BEAUVERIE, J., L'hypothèse du mycoplasma et les corpuscules métachromatiques. *Compt. Rend.* **152**:612-615. 1911.

⁷ PRITCHARD, F. J., The wintering of *Puccinia graminis Tritici* E. & H. and the infection of wheat through the seed. *Phytopathology* **1**:150-154. *pl. I. fig. 1*. 1911. See also *BOT. GAZ.* **52**:169-192. *pl. I. fig. 1*. 1911.

⁸ WILSON, MALCOLM, Spermatogenesis in the Bryophyta. *Ann. Botany* **25**:415-457. *pls. 37-38. figs. 3*. 1911.